



Westport



Cummins Westport Inc.

T h e F u t u r e i s C l e a r

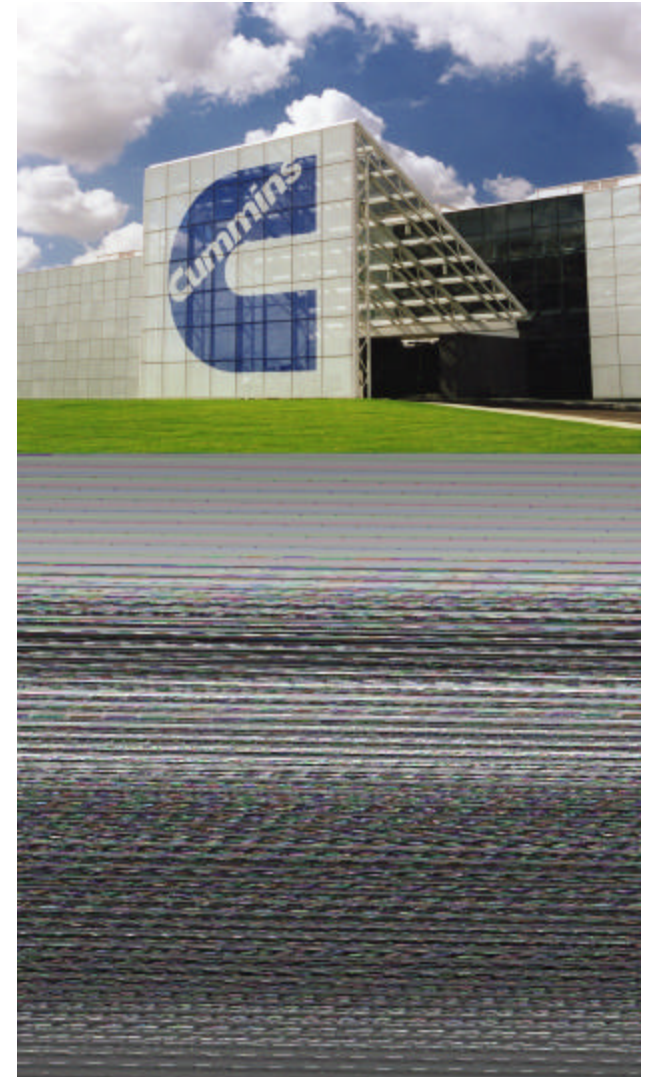
Powering the Planet - Protecting the Dream



THE CUMMINS DIESEL
*"Twice as Far for
Half as Much"*

Cummins Westport Inc

- **50 / 50 Joint Venture formed March, 2001**
- **Cummins**
 - World's largest builder of commercial diesels
 - +26,000 employees
- **Westport**
 - Small incubation technology company focused on natural gas
 - 200 employees



The Joint Venture's Mission

**Big
in
Clean Power**

10 Reasons To Be Bullish About N/Gas

1: Concern About Air Quality is Growing

Urban Pollution

Global Warming



10 Reasons To Be Bullish About N/Gas

2: Emissions Laws Will Get Tougher

- **EPA & Euro will squeeze allowable emissions:**
 - NOx - smog
 - PM - health issues
 - CO2 - global warming
- **U.S. EPA NOx standard (g/hp hr)**
 - Today 4 g
 - 2002 2.5g
 - 2007 1.2g
 - 2010 0.2g Proposed

10 Reasons To Be Bullish About N/Gas

3: Many Regions Will Go Further than the Legal Minimum with a Stick or Carrot

- **Mandates or regional rules will be more common**
 - **Like AQMD 1190 rules**
 - » **NO diesel school buses or refuse trucks in Southern California**
- **Incentives will increase & more programs to help adoption:**
 - **California Moyer Fund**
 - **U.S. federal bus funding pays 80% for clean buses**
 - **Powershift in U.K. pays 75%**
 - **Proposed US Clear Act**
 - » **\$28,000 in tax incentives per HD vehicle**

10 Reasons To Be Bullish About N/Gas

4: Natural Gas Infrastructure is Improving

- More Fuel stations
- Long run economics look good
- LNG market is emerging:
 - more range
 - lower tank & vehicle cost



10 Reasons To Be Bullish About N/Gas

5: NG Engine Technology is Getting Better

There's very few problems with natural gas power that can't be solved by just building better engines

- **Current reliability is 3X better than 1995**
- **Finally more customers are satisfied than mad**



10 Reasons To Be Bullish About N/Gas

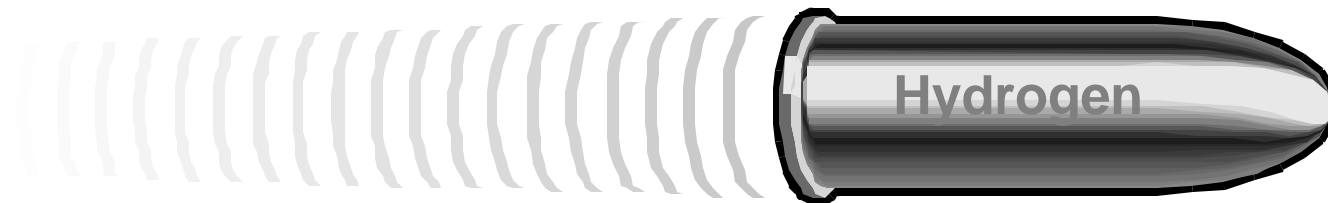
6: Nat Gas Trucks are Finally Available

- Technology has no value if you can't buy it
 - Autocar - available today
 - Freightliner Condor - available today
 - Freightliner Business Class - available soon
 - Peterbilt 320 - being evaluated



10 Reasons To Be Bullish About N/Gas

7: The Silver Bullet of Alternate Technologies is Pretty Slow



Hydrogen is very compelling, but issues like economics / technology / availability = TIME

10 Reasons To Be Bullish About N/Gas

8: Reciprocating Engines Will be Hard to Beat

- **The economics for reciprocating internal combustion engines are undisputed**
 - **Cost effective & productive**
- **Advanced reciprocating technology can offer very low emissions, eg. HYBRIDS**
 - **Diesel hybrids make great sense**
 - **Natural gas hybrids make even more sense**
- **“Well to Wheels”, “recips” are pretty good**

10 Reasons To Be Bullish About N/Gas

9: Natural gas is the ideal reciprocating engine fuel

- **Clean, Abundant & Economic**
- **Lowest carbon fuel**
 - 50 % lower NOx
 - 90 % lower PM
- **May be our best alternative for energy security**
- **May be the path to the Hydrogen economy:**
 - » **Short term**
 - » **Natural Gas infrastructure**
 - » **Natural gas in reciprocating internal combustion engines**

10 Reasons To Be Bullish About N/Gas

10: Cummins Westport Commitment

1. Continue the development of spark ignited natural gas engines 150 – 320 hp



Available TODAY

2. Develop new Westport cycle technology for larger HD engines 280 – 500 hp

Available 2004



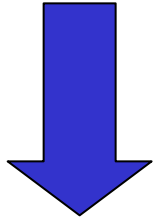
The JV's Mission

Big in Clean Power

- A. Make the existing spark-ignited natural gas business work today**
- B. Develop the new Westport HPDI Technology for the future**

Westport Cycle Engines

Westport Cycle



- A diesel engine that doesn't use diesel fuel

HPDI - High Pressure Direct Injection

- Uses diesel cycle combustion
- Diesel pilot ignites natural gas

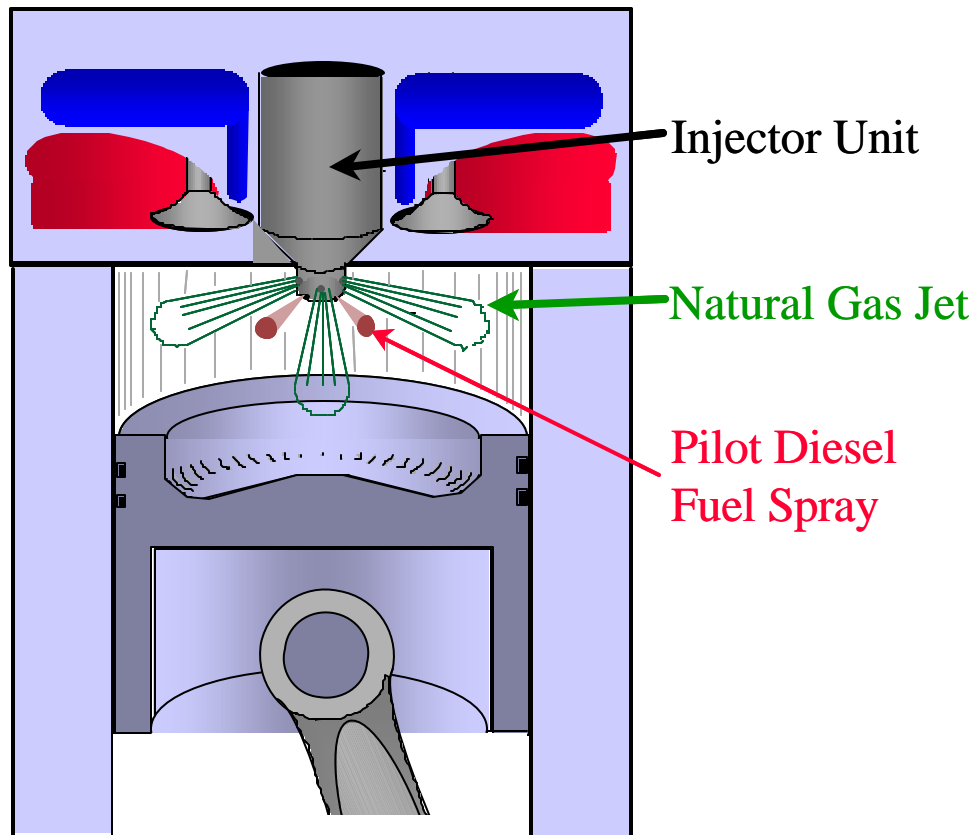
Westport's HPDI Approach

Keep the diesel engine - - -

**Change the fuel with HPDI
“plug-in” natural gas injection.**

Direct Injection Technology

High-Pressure Direct Injection



✍ Natural gas injected at hi pressure

✍ Pilot diesel injected for ignition

✍ Engine remains the same:

✍ Same power and torque

✍ Same high efficiency

✍ Diesel cycle, not Otto cycle

✍ not knock limited

✍ not sensitive to natural gas

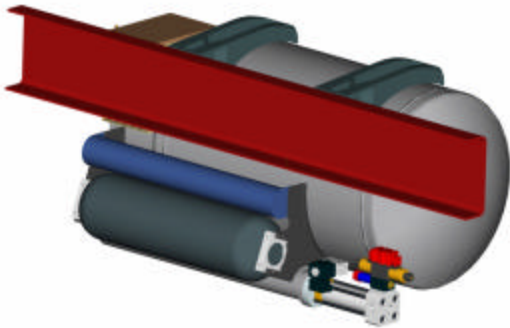
✍ 40% less NO_x

✍ 60% less PM

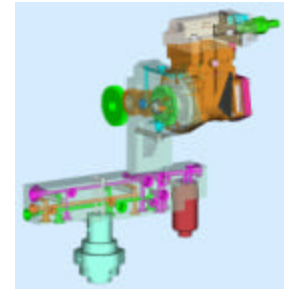
✍ 20% less CO₂

Average 95% Natural Gas

HPDI Modules



1. LNG Tank Module

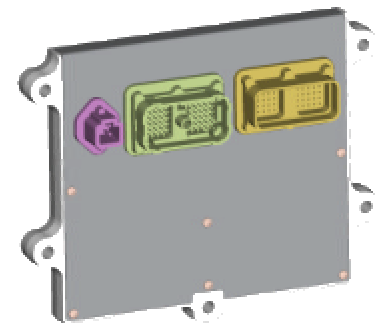


2. Integrated Fuel Supply Module



3. Injectors

4. Electronic Controls



HPDI Technology is Real



HPDI version of ISX-400 (1450 ft-lbs)

- 2000 - Engineering Truck
- Jan 01 - Delivered Raley's Truck (KW T-800)
- Feb 01 - Certified to CARB Optional low NOx (2.5g) emissions standard
- Mar 01 - Delivered Bobell Truck (KW T-800)
- 3Q01 - 14 trucks to Norcal Waste Systems in San Francisco (Peterbilt 378)



Overall HPDI Product Plan

- **Automotive**

- **2004**

- | | | |
|----------------|---------------------|-------------------|
| ISX Gas | 400 - 500 HP | 1450 lb ft |
|----------------|---------------------|-------------------|

- **2005**

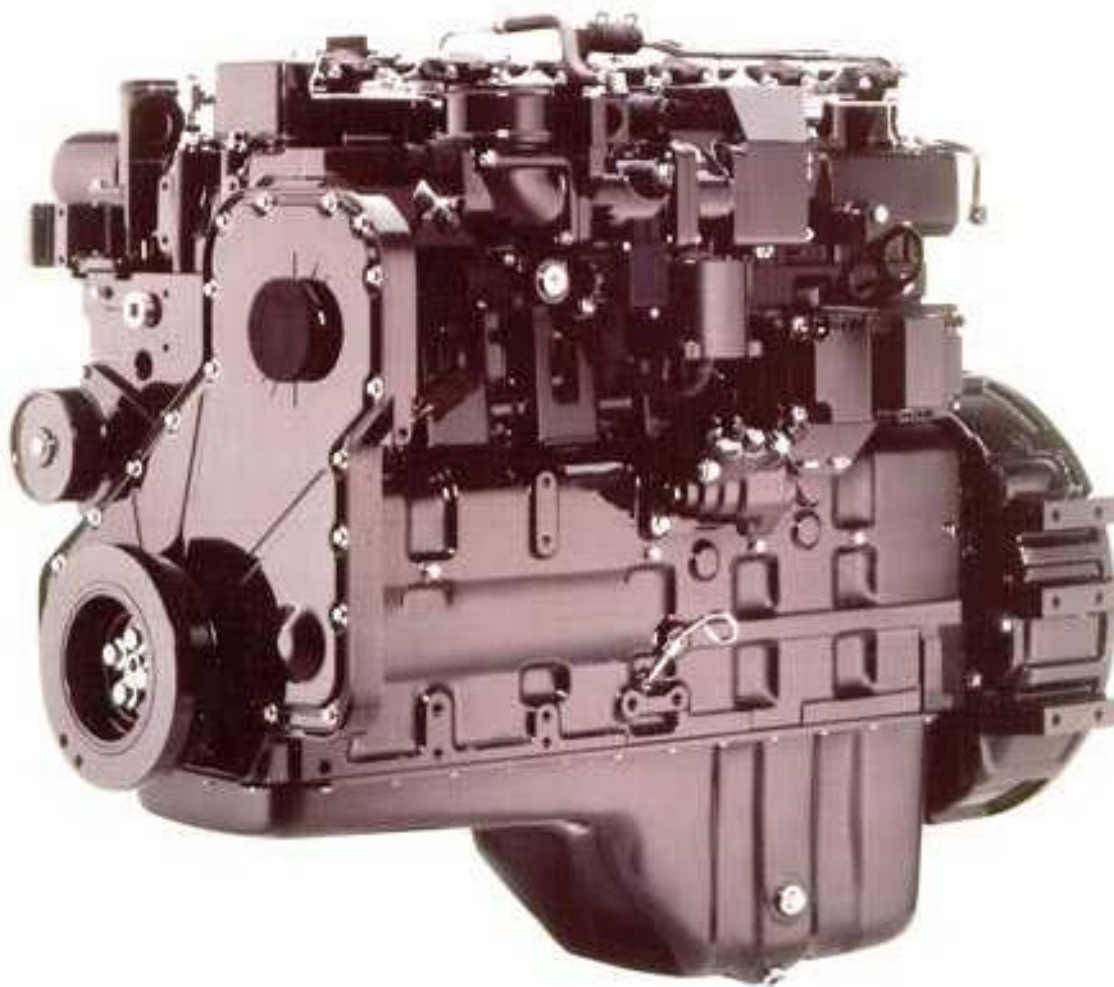
- | | | |
|----------------|---------------------|-------------------|
| ISM Gas | 280 - 370 HP | 1200 lb ft |
|----------------|---------------------|-------------------|

The JV's Mission

Big in Clean Power

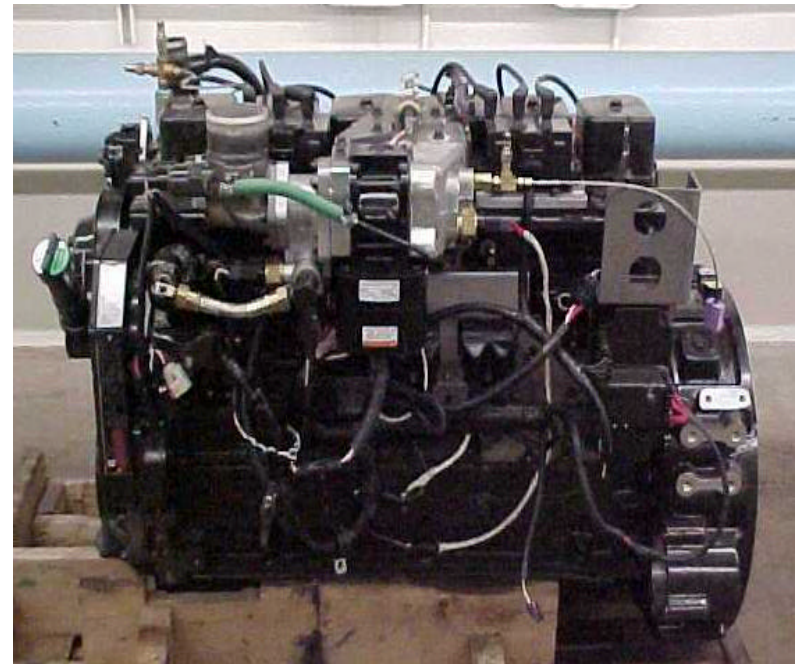
- A. Make the existing spark-ignited natural gas business work today**
- B. Develop the new Westport HPDI Technology for the future

C Gas Plus



B Gas Plus

- **Implementation of PLUS technology is underway**
- **Drive by wire**
- **Production launch 9/02**
- **To be certified to EPA, CARB and Euro 3 emissions**
- **Currently field testing**



L Gas Development

- Cummins 8.9 litre ISL engine will be launched using “C Plus” engineering
- 320 horsepower rating
- Available late 2002
- Aimed at urban transit and trucks needing more power than the C Gas Plus



Overall Product Plan

- **Spark Ignited:**

- 2002 B Gas Plus 230 hp 500 lb ft
- 2003 LG 320 hp 1000 lb ft
- 2003 B LPG Plus 195 hp HD10 LPG

- **Automotive HPDI:**

- 2004 ISX HPDI 400-500 HP 1450-1850 lb ft
- 2005 ISM HPDI 280-370 HP 1050-1450 lb ft